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final statement of the case of two floating bodies apparently comes to this: that the concave meniscus "acts upon both bodies toward a common centre of concavity," and also exerts upon these bodies a vertical downward force equal to the weight of the water sustained. If this is Professor Leconte's conception of the case, I do not feel to blame for not understanding him at first.

If, on the other hand, he supposes the weight of the water to be applied to the floating bodies, not by means of the surface-film, but in some other manner, it was, I submit, incumbent upon him to explain how and where he supposed it applied.

So much in explanation and support of my criticism of Professor Leconte's original statement. It is now, perhaps, worth while to examine a little further his final statement, as quoted above, beginning, "Indeed, it is obvious." Does not this statement, taken in connection with his first statement, also quoted above, lead directly to the conclusion that he supposes a column of water may be sustained between two bodies by capillary action without exerting any resultant downward force upon these bodies?—that, in short, the water is pulled up without any resultant tendency to pull the bodies down?

I have written thus at great length, and with perhaps unnecessary statement of elementary principles, because I intend this letter to be final upon my part.

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### THE INDIANA GEOLOGICAL REPORT.

*Indiana: department of geology and natural history. Eleventh annual report (1881).*.. John Collett, state geologist. Indianapolis, State, 1882. 401 p., 55 pl. 8°.

THIS volume contains some interesting scientific and economic matter, partly original, but largely in the form of useful reprints of things not accessible to the people whose needs it is meant to serve.

There is, in the first place, the report of a well-made inquiry into the transverse strength and elasticity of building-stones, principally of the excellent oolite of the St. Louis division of the sub-carboniferous limestones. The point is well made, that the resistance of hammered blocks of stone to compressive strains is very much less than that of sawed masses, owing to the unseen disintegration of the mass produced by the blows of the hammer. There is also the noteworthy suggestion, that the modulus of resistance to compression may be approximately estimated by the 'ring' of the mass when struck.

There are several county reports which have no general value. They contain some venturesome discussions of the extremely difficult problems connected with the work of the last glacial period in the Ohio valley. Glacial rivers, glacial lakes, ice-fronts, and all the other machinery of that time, are handled with charming ease and dexterity. We only hope the observers will work past this first transpar-

ent stage of the inquiry, and find how beyond imagination hard is this task of explaining the work of the ice-time, and how useless are such vague conjectures unfortified by the amplest delineation of facts.

In the report of Mr. Collett on Shelby county, we find the very interesting statement, that, in several wells sunk in one part of this county, heated waters have been struck within fifty feet of the surface. Nothing is given concerning the amount of flow of these waters or their chemical composition, nor are we told any thing concerning the goodness of the thermometers with which the observations were made,—all very important points. We only have the statement that the water was not potable, and that its temperature was as high as 86° F. As this district is below the level of the carboniferous series, it may not be reasonable to suppose that the temperature is due to the decomposition of iron pyrite, the only considerable known sources of that mineral available in this district being in the coal-measures. It is perhaps more probable that the temperature is due to downward penetration and return of water in a system of faults, which we must suppose to extend to a great depth, though they do not manifest themselves on the surface. If the waters are highly sulphurous, the origin of the heat in the decomposition of pyrite is the most probable; if they are not sulphurous, their source must be sought in faults. The question merits a careful study.

Two hundred pages of the text, and thirty-two of the plates, are reprints of James Hall's Waldron fossils, with some emendations, including four new plates.

Dr. Charles A. White gives a series of plates and descriptions of fossils from the collection of Mr. J. W. Van Cleve. Hall's monograph is well known to but few. It was originally published in the twenty-eighth report of that mysterious body corporate, the regents of the university of New York. This is the first publication of it that could have been of any use to Indian students.

The species described by Dr. White are chiefly corals, and are not regarded by the author as new species. This part of the work is essentially of local interest. All the species have been better set forth before, but never in a form so accessible for the dweller in the rural parts of Indiana.

Although there is not much that is original in this book, it very likely has a higher measure of utility for the people who pay for it than many a survey report that has better served the purposes of pure science. The old

day when the advance of American geology seemed to depend on state surveys is passing, and will soon pass away. They did good skirmish-work, and deserve to be remembered for many gifts to science; but the problems in scientific geology are now too large to be solved within the limits of a state. Scarce a state in this country has a question that can be properly considered from work done within its limits alone. In the future the state surveys can find their best place, not in efforts to develop general scientific problems, but rather in economic questions, which can always be localized, and in the work of bringing to the notice of the people whom they serve such matters of pure science as may naturally concern them. Other forms of research would better be left to the general government surveys, or to the studies of independent geologists.

It is now pretty well ascertained that our states are unwilling to support permanent scientific establishments on such a scale as will enable them to do good scientific work, but they will pay some one or two men to keep a sharp lookout for any utilities that may be discovered. Fortunately nature so mingles the 'utile' and the 'dulce,' that some good to science will come out of this care for profit, which is to be in the future the task of the state surveyor.

#### M. HERMITE'S LECTURES.

*Cours de M. Hermite, professé pendant le 2<sup>e</sup> semestre 1881-82. Rédigé par M. ANOYER, élève de l'École normale supérieure. Second tirage revu par M. HERMITE (Librarie scientifique). Paris, A. Hermann, 1883.*

This work of M. Hermite fills, in great part, a decided gap in mathematical literature, and affords a means to American mathematical students, at least, of overcoming a difficulty that of late has become rather serious. With the exception of those who have had the opportunity of listening to the lectures of Hermite or Weierstrass on the theory of functions of a complex variable, all students interested in that subject must have experienced a great deal of difficulty in reading the more modern memoirs which deal with it. Some such book as Durège's, or Neumann's, on Riemann's theory, is very much wanted on what may, with propriety, be called the Weierstrass-Hermite theory of functions. The necessity for such a treatise is steadily increasing, as any one will readily see by looking over the last few volumes of *Crelle-Borchardt*, the *Mathematische annalen*, the *Annali di matematica*, or the

two numbers which have already appeared of *Mittag-Leffler's acta mathematica*. The present work by M. Hermite does not profess to be such a treatise. In fact, it is not a treatise at all, but, as its title implies, simply the course of lectures given at the Sorbonne by M. Hermite, and treating of quite an extended list of subjects. The principal topics discussed are the quadrature and rectification of curves, the determination of the areas and volumes of curved surface, the general theory of functions of a complex variable, and the application of this theory to the study of the Eulerian integrals and the elliptic functions.

The first five chapters are devoted to geometry, and contain applications which are chosen with a view to what is contained in the succeeding chapters. Since, for the rectification of conics and the quadrature of plane cubics, it is necessary to consider integrals of the form  $\int f(xy) dx$ , where  $f(xy)$  is a rational function of  $x$  and  $y$ , and  $y$  is the square root of a quartic function of  $x$ , the author takes up this general integral, and gives Legendre's reduction to the normal forms of the elliptic integrals, and also some of Tchebychef's results concerning the cases where the elliptic integrals are reducible to algebraico-logarithmic functions.

The next three chapters are taken up with an exposition of the more elementary properties of functions of a complex variable, the author giving an account of Darboux's investigations relatively to the integral  $\int_a^b F(x) f(x) dx$ , where  $F(x)$  is, between the limits, always positive,  $f(x)$  is a continuous function of the form  $\phi(x) + i\psi(x)$ , and where  $a$  and  $b$  are real. Another method, due to Weierstrass, for integrals of this nature, is also indicated.

In the next four chapters the immediate consequences of Cauchy's theorem are developed, and an account given of Weierstrass's and Mittag-Leffler's investigations in the theory of uniform functions, including their decomposition of a holomorphic function into prime factors, and their general expression for a uniform function with an infinite number of poles, or of essential singular points, the last being due almost solely to Mittag-Leffler.

The next three chapters deal with the Eulerian integrals, and include Prym's expression for  $\Gamma(x)$ , and Weierstrass's expression for  $\frac{1}{\Gamma(x)}$ , and a demonstration by M. Hermite

of Laplace's formula for the approximate calculation of  $\Gamma(x)$ , where  $x$  is a very large integer.